The Department of Engineering Physics administers the B.S., M.S., and Ph.D. degrees in engineering mechanics. The B.S. degree in engineering mechanics may be accompanied by an option in astronautics (http://guide.wisc.edu/undergraduate/engineering/engineering-physics/engineering-mechanics-bs/engineering-mechanics-astronautics-bs).

Engineering mechanics is the scholarly term for the study of forces and the resulting deformations, accelerations, motions, vibrations and other action that they cause. As such, engineering mechanics forms the foundation of a degree in aerospace, mechanical or civil engineering and it is fundamental to important parts of biomedical engineering, chemical engineering, materials science, and other engineering disciplines. Hence, a degree in engineering mechanics provides a broad scientific background which enables its graduates to tackle challenging problems in most fields of engineering. The curriculum emphasizes the basic sciences—mathematics, computer science, physics and the engineering sciences—fluid dynamics, thermodynamics, mechanics, materials science, and electrical engineering. Although the degree program is entitled engineering mechanics at UW–Madison, the program is most comparable to aerospace engineering and mechanical engineering programs at various universities across the United States. However, internationally, this field is more commonly known as “mechanics” rather than “mechanical engineering” or “aerospace engineering.” A few select universities in the United States offer programs that are similar to UW–Madison’s engineering mechanics program under titles such as “engineering science” or “theoretical and applied mechanics.”

The objective of the program is to provide the student with a broad background in the fundamental physical sciences and applied mathematics, coordinated with both theoretical and applied engineering methods and experimental techniques. This type of educational background will give the student the degree of versatility necessary for dealing with the variety and complexity of modern technological problems as well as the ability to adapt to the rapidly changing needs and interests of industry, government, and society.

An education in engineering mechanics provides many advantages. First, the foundation offered by a degree in mechanics allows our graduates to more easily interact with co-workers on interdisciplinary teams including chemists, physicists, and mathematicians. Second, many industrial organizations prefer engineers that have a broad, fundamental scientific background rather than a narrow view of just one discipline. Third, and probably most important, great changes have taken place in science and engineering during recent years. Among the most important of these have been the rapid diffusion of scientific knowledge and disciplines into engineering, the increasing use of analytical and computer methods for the solution of practical problems, the need for a better understanding of the properties and behavior of materials, and the increasing need for engineers who can adapt known methods to new situations and develop new experimental and analytical methods. By focusing on core competency in physics and applied mathematics the engineering mechanics degree prepares students for these challenges.

The required courses taken early in the curriculum are intended to give the student a fundamental background in mathematics, science, and engineering. In addition to developing versatility through exposure to important concepts in various scientific fields, the required courses allow the students to identify areas of interest. With the relatively large number of elective credits available in the latter part of the program, the student may either continue to follow a general program or may prefer to concentrate elective courses in such areas as stress analysis and structural mechanics, dynamics and vibrations, aerodynamics and flight mechanics, experimental mechanics, applied mathematics, materials science, geological engineering, biomechanics, aerospace mechanics, mechanical systems analysis, etc.

Engineering mechanics graduates are sought by most industries and governmental agencies including in particular those participating in the newly developing areas of engineering such as space technology, performance of new structural materials, and so on. Their work often involves participation in design, research and development projects where the problems are sufficiently complex or unusual that their solutions require engineers with (1) a thorough understanding of the fundamentals of engineering, (2) advanced education in the established experimental and analytical methods, and (3) the ability to develop new experimental and analytical methods to attack problems for which standard methods, formulas, and materials have not yet been developed. The program also provides excellent preparation for graduate study in a variety of related disciplines.

**ENGINEERING MECHANICS AND NUCLEAR ENGINEERING PROGRAM EDUCATIONAL OBJECTIVES**

The faculty recognize that our graduates will choose to use the knowledge and skills they have acquired during their undergraduate years to pursue a wide variety of career and life goals and we encourage this diversity of paths. Initially, we expect graduates will begin their careers in fields that utilize their knowledge, education and training in solid mechanics and fluid mechanics as it applies to aeronautics/astronautics and mechanics in design and manufacturing.

Whatever path our graduates choose to pursue, our educational objectives for the nuclear engineering and engineering mechanics programs are to allow them to:

1. Exhibit strong performance and continuous development in problem-solving, leadership, teamwork, and communication, initially applied to nuclear engineering or engineering mechanics, and demonstrating an unwavering commitment to excellence.
2. Demonstrate continuing commitment to, and interest in, his or her training and education, as well as those of others.
3. Transition seamlessly into a professional environment and make continuing, well-informed career choices.
4. Contribute to their communities.

**HOW TO GET IN**

**ADMISSION TO THE COLLEGE AS A FRESHMAN**

Students applying to UW–Madison (https://www.admissions.wisc.edu/apply) need to indicate an engineering major (https://www.engr.wisc.edu/academics/undergraduate-academics/choosing-a-major) as their first choice in order to be considered for direct admission to the College of Engineering. Direct admission to a major means students will start in the program of their choice in the College of Engineering and will need to meet progression requirements (https://www.engr.wisc.edu/academics/student-services/academic-advising/first-year-undergraduate-students/progression-requirements) at the end of the first year to guarantee advancement in that program.
CROSS-CAMPUS TRANSFER TO ENGINEERING

UW-Madison students in other schools and colleges on campus must meet the course and credit requirements for admission to engineering degree granting classifications specified in the general college requirements (https://www.engr.wisc.edu/academics/student-services/academic-advising/cross-campus-students). The requirements are the minimum for admission consideration. Cross-campus admission is competitive and selective, and the grade point average expectations may increase as demand trends change. The student's overall academic record at UW-Madison is also considered. Students apply to their intended engineering program by submitting the online application by stated deadlines for spring and fall. The College of Engineering offers an online information tutorial and drop-in advising (https://www.engr.wisc.edu/academics/student-services/academic-advising/cross-campus-students) for students to learn about the cross-campus transfer process.

OFF-CAMPUS TRANSFER TO ENGINEERING

With careful planning, students at other accredited institutions can transfer coursework that will apply toward engineering degree requirements at UW–Madison. Off-campus transfer applicants are considered for direct admission to the College of Engineering by applying to the Office of Admissions with an engineering major listed as their first choice. Those who are admitted to their intended engineering program must meet progression requirements (https://www.engr.wisc.edu/academics/student-services/academic-advising/transfer-students) at the point of transfer or within their first two semesters at UW–Madison to guarantee advancement in that program. A minimum of 30 credits in residence in the College of Engineering is required after transferring, and all students must meet all requirements for their major in the college. Transfer admission to the College of Engineering is competitive and selective, and students who have earned more than 80 transferable semester credits at the time of application are not eligible to apply.

The College of Engineering has dual degree programs with select four-year UW System campuses. Eligible dual degree applicants are not subject to the 80 credit limit.

Off-campus transfer students are encouraged to discuss their interests, academic background, and admission options with the Transfer Coordinator in the College of Engineering: ugtransfer@engr.wisc.edu or 608-262-2473.

SECOND BACHELOR’S DEGREE

The College of Engineering does not accept second undergraduate degree applications. Second degree students (https://www.engr.wisc.edu/admissions/undergraduate-admissions/returning-adults-second-degree-students) might explore the Biological Systems Engineering program at UW–Madison, an undergraduate engineering degree elsewhere, or a graduate program in the College of Engineering.

REQUIREMENTS

UNIVERSITY GENERAL EDUCATION REQUIREMENTS

All undergraduate students at the University of Wisconsin–Madison are required to fulfill a minimum set of common university general education requirements to ensure that every graduate acquires the essential core of an undergraduate education. This core establishes a foundation for living a productive life, being a citizen of the world, appreciating aesthetic values, and engaging in lifelong learning in a continually changing world. Various schools and colleges will have requirements in addition to the requirements listed below. Consult your advisor for assistance, as needed. For additional information, see the university Undergraduate General Education Requirements (http://guide.wisc.edu/undergraduate/#requirementsforundergraduatetestudytext) section of the Guide.

General Education
- Breadth—Humanities/Literature/Arts: 6 credits
- Breadth—Natural Science: 4 to 6 credits, consisting of one 4- or 5-credit course with a laboratory component; or two courses providing a total of 6 credits
- Breadth—Social Studies: 3 credits
- Communication Part A & Part B *
- Ethnic Studies *
- Quantitative Reasoning Part A & Part B *

* The mortarboard symbol appears before the title of any course that fulfills one of the Communication Part A or Part B, Ethnic Studies, or Quantitative Reasoning Part A or Part B requirements.

ENGINEERING MECHANICS CURRICULUM

The following curriculum applies to students who entered the College of Engineering in fall 2018 or later.

SUMMARY OF REQUIREMENTS

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>MATH 221</td>
<td>Calculus and Analytic Geometry I</td>
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</tr>
<tr>
<td>or MATH 217</td>
<td>Calculus with Algebra and Trigonometry II</td>
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</tr>
<tr>
<td>or MATH 275</td>
<td>Topics in Calculus I</td>
<td></td>
</tr>
<tr>
<td>MATH 222</td>
<td>Calculus and Analytic Geometry II</td>
<td>4-5</td>
</tr>
<tr>
<td>or MATH 276</td>
<td>Topics in Calculus II</td>
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</tr>
<tr>
<td>MATH 234</td>
<td>Calculus–Functions of Several Variables</td>
<td>4</td>
</tr>
<tr>
<td>MATH 320</td>
<td>Linear Algebra and Differential Equations</td>
<td>3</td>
</tr>
<tr>
<td>MATH 321</td>
<td>Applied Mathematical Analysis</td>
<td>3</td>
</tr>
<tr>
<td>STAT 324</td>
<td>Introductory Applied Statistics for Engineers</td>
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</tr>
<tr>
<td>or STAT 311</td>
<td>Introduction to Theory and Methods of</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mathematical Statistics</td>
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MATHMATICS AND STATISTICS

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<tr>
<td>STAT 324</td>
<td>Introductory Applied Statistics for Engineers</td>
<td>3</td>
</tr>
<tr>
<td>STAT 311</td>
<td>Introduction to Theory and Methods of Mathematical Statistics</td>
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<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>STAT 224</td>
<td>Introduction to Theory and Methods of Mathematical Statistics</td>
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</tr>
<tr>
<td>STAT 324</td>
<td>Introductory Applied Statistics for Engineers</td>
<td>3</td>
</tr>
<tr>
<td>or STAT 311</td>
<td>Introduction to Theory and Methods of Mathematical Statistics</td>
<td>1</td>
</tr>
<tr>
<td>Code</td>
<td>Title</td>
<td>Credits</td>
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<td>----------</td>
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</tr>
<tr>
<td>E M A 521</td>
<td>Aerodynamics</td>
<td>3</td>
</tr>
<tr>
<td>or M E 563</td>
<td>Intermediate Fluid Dynamics</td>
<td>3</td>
</tr>
<tr>
<td>E M A 542</td>
<td>Advanced Dynamics</td>
<td>3</td>
</tr>
<tr>
<td>or E M A 545</td>
<td>Mechanical Vibrations</td>
<td>3</td>
</tr>
<tr>
<td>E M A 569</td>
<td>Senior Design Project</td>
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</table>

**Total Credits: 31**

**ENGINEERING MECHANICS AND ASTRONAUTICS ELECTIVES**

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Select 9 credits from any E M A course numbered 500 and above</td>
<td>9</td>
<td></td>
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</table>

**TOTAL CREDITS: 128**

For information on credit load, adding or dropping courses, course substitutions, pass/fail, auditing courses, dean's honor list, repeating courses, probation, and graduation, see the College of Engineering.
ASTRONAUTICS OPTION IN ENGINEERING MECHANICS

HONORS IN UNDERGRADUATE RESEARCH PROGRAM

UNIVERSITY DEGREE REQUIREMENTS

LEARNING OUTCOMES

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. an ability to communicate effectively with a range of audiences
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.
General Chemistry I and CHEM 104 General Chemistry II for a total of 9 credits.

2 Students who were not able to take INTEREGR 170 Design Practicum as freshmen may, with the approval of their advisor, substitute a course offered in the College of Engineering or in the departments of Chemistry, Computer Sciences, Mathematics, and Physics.

3 Students may substitute PHYSICS 201 General Physics, 5 credits, for E M A 201 Statics, 3 credits, with the approval of their advisor.

4 After completing E M A 201 Statics, students may take E M A 202 Dynamics and E M A 303 Mechanics of Materials/E M A/M E 307 Mechanics of Materials Lab in either order or concurrently.

5 Students electing E M A 545 Mechanical Vibrations instead of E M A 542 Advanced Dynamics should note that E M A 545 Mechanical Vibrations is offered in the spring semester only.

6 E M A 611 Advanced Mechanical Testing of Materials or E M A/M E 540 Experimental Vibration and Dynamic System Analysis or E M A/M E 570 Experimental Mechanics or E M A 522 Aerodynamics Lab. Note that EMA/ME 540 and EMA/ME 570 and are typically offered in the fall. EMA 611 and EMA 522 are typically offered in the spring.

7 M E 563 Intermediate Fluid Dynamics may be substituted for E M A 521 Aerodynamics. Note that M E 563 is offered in the spring semester only.

ADVISING AND CAREERS

ADVISING

Each College of Engineering program has academic advisors dedicated to serving its students. Program advisors can help current College of Engineering students with questions about accessing courses, navigating degree requirements, resolving academic issues and more. Students can find their assigned advisor on the homepage of their student center.

Continuing students who have fulfilled the progression requirements will also be assigned an Engineering Mechanics faculty advisor. Before enrolling in courses each semester, students must meet with their faculty advisor for assistance in planning courses and reviewing degree requirements. Faculty advisors are a valuable resource, as they can provide students with in-depth guidance on course content, internship and job opportunities, research, and more.

ENGINEERING CAREER SERVICES

Engineering Career Services (ECS) assists students in identifying pre-professional work-based learning experiences such as co-ops and summer internships, considering and applying to graduate or professional school, and finding full-time professional employment during their graduation year.

ECS offers two major career fairs per year, assists with resume writing and interviewing skills, hosts workshops on the job search, and meets one-on-one with students to discuss offer negotiations.

Students are encouraged to utilize the ECS office early in their academic careers. For comprehensive information on ECS programs and workshops, see the ECS website or call 608-252-3471.

PEOPLE

PROFESSORS

Henderson (chair)
Blanchard
Bonazza
Bronkhorst
Crone
Fonck
Hegna
Lakes
Schmitz
Smith (also Mathematics)
Sovinec
Waleffe (also Mathematics)
Wilson

ASSOCIATE PROFESSORS

M. Allen
Witt

ASSISTANT PROFESSORS

Choy
Couet
Franck
Geiger
Notbohm
Thevamaran

See department website (https://directory.engr.wisc.edu/display.php?faculty/?page=ep&search=faculty) for list.

RESOURCES AND SCHOLARSHIPS

FACILITIES

Facilities available for instruction and research include:

Mechanics Holographic Lab
Viscoelasticity and Composites Lab
Wisconsin Laboratory for Structures and Materials Testing: Materials Testing Lab
Wind Tunnel Laboratory
Structural Mechanics Lab
Structural Dynamics and Vibrations Lab
Fatigue/Fracture Lab
Instructional Computing Lab (in Computer Aided Engineering)
Research Computing Lab

ACCREDITATION

Accreditation.


Note: Undergraduate Program Educational Objectives and Student Outcomes are made publicly available at the Departmental website.
(In this Guide, the program's Student Outcomes are designated by our campus as "Learning Outcomes.")